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NOZZLE FOR CONTINUOUS CASTING

Shigeyuki Takeshita et al.

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NOZZLE FOR CONTINUOUS CASTING

[Renzoku chuzo yo nozuru]

Inventors: Shigeyuki Takeshita et al.

Applicant: Kawasaki Furnace K.K.

[There are no amendments to this patent.]

Claim

A nozzle for continuous casting, characterized by the fact that a coating layer with a prescribed thickness is formed of a lime material containing 50-100 wt% CaO is formed at an inner wall hole and/or a jet port of the main body.

Detailed explanation of the invention

Industrial application field

In a continuous casting, an ingot steel is sequentially transferred via a nozzle (long nozzle, tundish nozzle, or immersion dish) from a ladle, and an alumna graphite refractory material is used in the nozzle.

The alumina graphite refractory material is excellent in corrosion and the spalling resistance, however the nozzle is easily clogged by the attachment of the alumina being precipitated from the ingot steel. Especially in an aluminum killed steel, nonmetallic inclusions such as Al_2O_3 as a deoxidized product in the ingot steel exist, and these substances are attached to the inner wall hole or the jet port of the nozzle, gradually grow, and eventually clog it.

Also, if a cluster or closed product of the above-mentioned nonmetallic inclusions in the ingot steel is trapped in a cast product, it causes a defect in the product.

In order to solve this problem, a method that blows an inert gas into the inner peripheral surface of the nozzle and prevents the attachment of nonmetallic inclusions such as Al_2O_3 is known, however even if this method is used, if a continuous casting is repeated, the above-mentioned nonmetallic inclusions grow in the nozzle jet port, and clogging is caused, so that a stable closure prevention effect cannot be obtained.

Also, a method that absorbs and filters deoxidized products by disposing a filter of Al_2O_3 material or CaO material in the tundish or hole in the nozzle is known. However, in case the filter is clogged by the deoxidize products, labor and time are required for replacing the filter, and problems occur in the operation.

Means to solve the problems

The present invention is proposed in consideration of the above-mentioned conventional situation, and its purpose is to provide a nozzle for continuous casting in which nonmetallic inclusions are not attached to the inner wall hole or jet port of the nozzle.

In order to achieve the above-mentioned purpose, the present invention adopts the following means. In other words, a coating layer with a prescribed thickness is formed of a lime material containing 50-100 wt% CaO is formed at an inner wall hole and/or a jet port of a nozzle of the nozzle body.

Operation

Thus, CaO of the lime material coating layer and Al_2O_3 as a nonmetallic inclusion in an ingot steel react with each other to generate a composition with a low melting point and a low specific gravity such as $12CaO \cdot 7Al_2O_3$ and $3CaO \cdot Al_2O_3$, so that nonmetallic inclusions are removed. At the same time, the above-mentioned composition with a low melting point flows out of the nozzle jet port, floats in a mold, and does not mix into the cast product.

The coating layer is slowly thinned by the melting loss, and if the containing layer disappears, the nozzle may be exchanged.

As the above-mentioned lime material, lime clinker, dolomite clinker, magnesia lime clinker, etc., are used, and it is preferable for its composition to include 50-100 wt% CaO. If the composition is less than 50%, the above-mentioned effects are lessened.

The thickness of the coating layer is preferably the thickness corresponding to the life of the nozzle body, that is, 5-10 mm, and if the thickness is smaller than 5 mm, the melting loss is accelerated, so that the nozzle must be exchanged while the life of the nozzle body should be longer. On the contrary, if the thickness is greater than 10 mm, only the coating layer remains, even if the life of the nozzle body ends, so that the economical efficiency is poor.

The above-mentioned coating layer may be molded in a body when the nozzle body is formed, and after separately molding the nozzle body and the coating layer, the coating layer may also be inserted into the nozzle body. Furthermore, after molding the nozzle body, the coating layer may also be formed by casting, etc.

Also, the nozzle body is formed of a refractory material containing 10-50 wt% graphite, as is conventional, and as refractory raw materials other than the graphite, alumina, silica, zirconia, silicon carbide, zircon, silicon, etc., are mentioned. If the graphite is smaller than 10 wt%, the heat-resistant impact is inferior, and if the graphite is greater than 50 wt%, the oxidation resistance and the ingot steel durability is lowered.

Application Example 1

80 wt% lime clinker, 20 wt% magnesia clinker, 10 wt% powder resin binder, and 10 wt% water-insoluble solvent were kneaded, cast at a thickness of 10 mm into an inner wall hole of an alumina graphite nozzle (25 wt% graphite), and molded.

Application Example 2

Similarly to Application Example 1 for except for using a dolomite clinker instead of the lime clinker of the above-mentioned Application Example 1, a nozzle was molded.

Also, in Application Examples 1 and 2, as shown in Figure 1(a), a coating layer 2 was formed on the entire part of a jet port 3 and an inner wall hole 4 of a nozzle body 1, however as shown in Figure 1(b), the coating layer 2 may also be formed on the lower half part of the jet port 3 and the inner wall hole 4.

Furthermore, as a comparative example to the above-mentioned Application Examples 1 and 2, a conventional ordinary alumina graphite nozzle in which a lime coating layer was not formed was used.

Table 1 shows attachments of the inner wall hole 4 of the nozzle described in Application Examples 1 and 2, the amount of the two items, inner wall hole 4 and jet port 3, of the nozzle being melted, and the number of large-scale inclusions in the ingot steel in the mold after

continuously casting an aluminum kilned steel (an ingot steel temperature of 1,550-1,570°C) for 180 min.

As also seen from Table 1, Application Examples 1 and 2 show good results for all of the above-mentioned four items, compared with the prior art.

Table 1

	1 実施例 I	2 実施例 II	3 比較例
4 ノズル内付着物	なし 8	なし 8	あり 9
5 ノズル内孔溶損量	1 mm	1 mm	1.5 mm
6 ノズル吐出口溶損量	1 mm	1 mm	3.5 mm
7 モールド内溶鋼中の大型介在物数	なし 8	なし 8	50(ヶ/kg·steel) 10

Key:
1 Application Example __
2 Comparative example __
3 Comparative example
4 Attachments in the nozzle
5 Amount of inner hole in the nozzle melt
6 Amount of nozzle jet port melt
7 Large-scale inclusions in the ingot steel in the mold
8 None
9 Present
10 50 (pieces/kg·steel)

Effects of the invention

As explained above, according to the present invention, since nonmetallic inclusions such as alumina are removed by the coating layer of CaO formed at the inner wall hole and/or the jet port of the nozzle, nonmetallic inclusions are not attached to the inner hole and the jet port of the nozzle, not to mention no clogging phenomenon. Furthermore, the above-mentioned nonmetallic inclusions are not likely to flow into the mold and to be mixed into the cast product

Brief description of the figure

Figures 1(a) and (b) are cross sections showing an example of the immersion nozzle of the present invention.

1 Nozzle body
2 Coating layer
3 Jet port
4 Inner wall hole in the nozzle

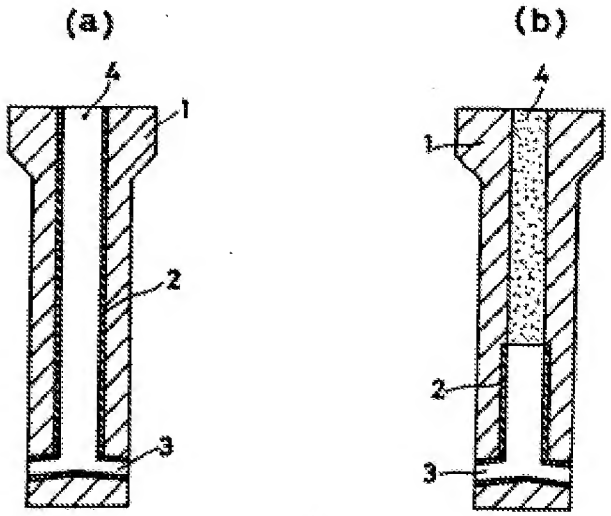

Figure 1